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SUSQUEHANNA RIVER BASIN COMMISSION
5012 LENKER STREET
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STAFF REVIEW
OF
ACID MINE DRAINAGE ABATEMENT
IN THE
TIOGA RIVER BASIN
(AS AMENDED)

FEBRUARY 13, 1975

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TABLE OF CONTENTS

Page

I. INTRODUCTION..... 1

A. Purpose and Basis of this Review..... 1

B. Description..... 2

1. Major Subsurface Conditions Causing Acid Mine Drainage..... 4

2. Major Surface Conditions Causing Acid Mine Drainage..... 7

3. Mine Drainage Impact..... 8

II. DISCUSSION OF STUDY RECOMMENDATION.....11

III. AREAS OF CONCERN.....12

IV. SUMMARY AND RECOMMENDATIONS.....14

Figures

1. Tioga River Watershed And Location Map..... 3

2. Section Along Synclinal Axis Showing Configuration Of Coal Seams in Tioga Coal Basin..... 6

INTRODUCTION

A. Purpose and Basis of This Review

The Commission, created by a Federal-Interstate Compact, P.L. 91-575 (84 Stat. 1509 et seq.), is the regional government agency responsible for effecting comprehensive multipurpose planning, programming and management of the water and related resources for the Susquehanna River Basin. It fulfills this mandated duty by exercising authority in the Compact providing for implementation of its Comprehensive Plan for management and development of the water resources of the Susquehanna River Basin, coordination of planning efforts and programs of government agencies and the private sector, and review of projects affecting the water and related resources of the basin.

The Commission reviews projects to ascertain the projects' compatibility with the objectives, goals, guidelines and criteria set forth in the Comprehensive Plan. The purpose of this review is to evaluate the Baltimore District, Corps of Engineers report titled "Susquehanna Mine Drainage Study Interim Report, Tioga River Basin" and to enlist assistance in the abatement of acid mine drainage pollution in the Tioga River Basin through elimination or correction of the conditions contributing to the formation of acid water in abandoned mines.

Abatement of acid mine drainage in the Tioga River Basin is

important due to Federal interest in constructing the multi-purpose dams near Tioga, Pennsylvania. This project, known as the Tioga-Hammond Lakes, has been designed to provide a combination of two dams in adjacent valleys connected by a gated channel. One dam will impound Crooked Creek, which is alkaline under all flow conditions. The gated connecting channel will regulate the flow between the two impoundments in order to minimize adverse acid mine drainage effects on Tioga Lake and on the Tioga River downstream from the impoundments.

In a 1971 Corps of Engineers report entitled "Investigative Survey -- Occurrence and Effects of Mine Drainage in the Tioga River Watershed," the Corps concluded that Tioga Lake could be maintained in an alkaline condition under all flow conditions in the Tioga River by the implementation of acid mine drainage abatement measures. Alkaline water more consistently entering Tioga Lake would enhance the recreational usage of the lake and provide a greater potential public use of the river above and below the impoundment as the result of better water quality.

B. Description

The Tioga River originates in Armenia Township in western Bradford County. It flows in a southwesterly direction into Tioga County near Blossburg, Pennsylvania, and thence in a northerly direction to join the Chemung River in New York State (Figure 1).

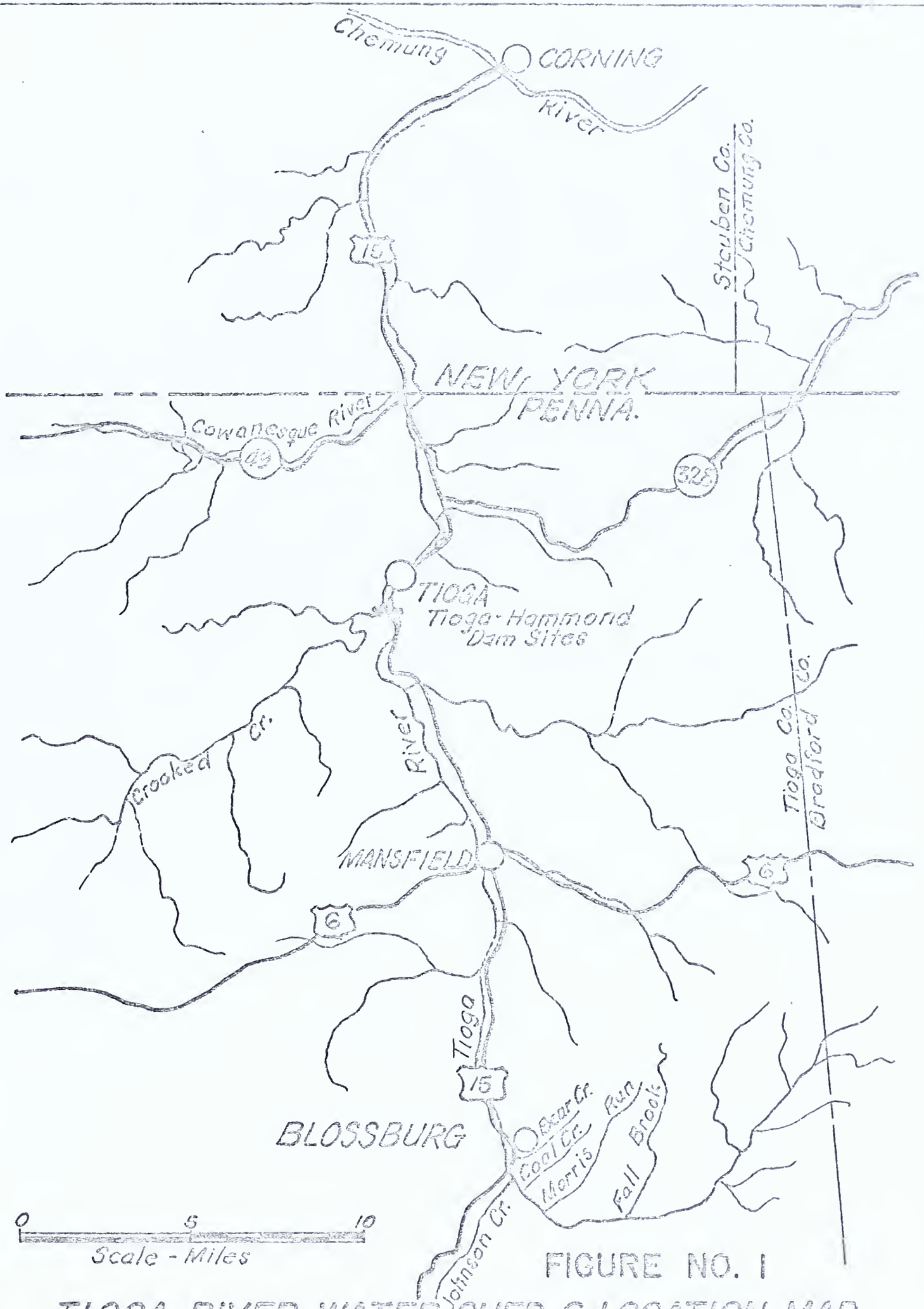

FIGURE NO. 1

TIOGA RIVER WATERSHED & LOCATION MAP

Located within the Allegheny Plateau physiographic province, the basin is characterized by broad valleys and steep, rounded hills. Shale and sandstone, along with coal in the upper part of the area, are the dominant geologic formations. Most of the stream channels are bordered by wide, alluvial flood plains containing deposits of glacially derived boulders and gravel. Coal deposits are located in the extreme headwaters of the stream and are contained in a canoe-shaped, synclinal basin, underlying the watersheds of Morris Run, Coal Creek, Bear Creek, and Johnson Creek.

Prior to World War II, all mining in the Tioga Coal Basin was conducted by deep mining methods. During and after the war, strip mining became dominant. Reserves of coal have been estimated at a total of 40 million short tons, with approximately 16 million short tons considered recoverable.

With exception of coal mining, farming, timber cutting and a foundry operation located in the Borough of Blossburg, very little industry exists within or in close proximity to the area. The area is sparsely populated with most inhabitants residing in Morris Run Village and the Borough of Blossburg.

1. Major Subsurface Conditions Causing Acid Mine Drainage

Nine coal seams underlie the Tioga River headwaters area; namely, the Brookville, Lower Kittanning, Foot, Middle Kittanning, Freak, Upper Kittaning, Monkey, Lower

Freeport, and Upper Freeport seams. Acid producing materials are associated with all of these seams, most notably the Brookville, Lower Kittanning, and Lower Freeport. The major synclinal axis of the coal measures extends in a northeast-southwest direction roughly through the center of the area. The bottom of this syncline is located toward the southwest portion of the area, near Coal Creek. Coal seams rise gradually to the northwest and southeast from the synclinal axis to outcrop along the hillsides. Extensive deep mining was done in the Lower Kittanning, Upper Kittanning and Lower Freeport seams. Less extensive deep mining was done in the Brookville, Middle Kittanning, Upper Freeport, Foot, Freak, and Monkey seams. A typical configuration of coal seams in the Morris Run area is shown on Figure 2.

During the course of deep mining in the Morris Run area, numerous entries were driven into the underground to gain access to the coal and to enable its removal. Since deep mining for the most part was conducted below then existing ground and perched water tables, various drifts were driven to allow for the gravity discharge of mine drainage from the workings. These drifts were at one of two general locations, namely at outcroppings along the southwest side of the middle and lower reaches of Bear and Coal Creeks. Deep mining was planned and

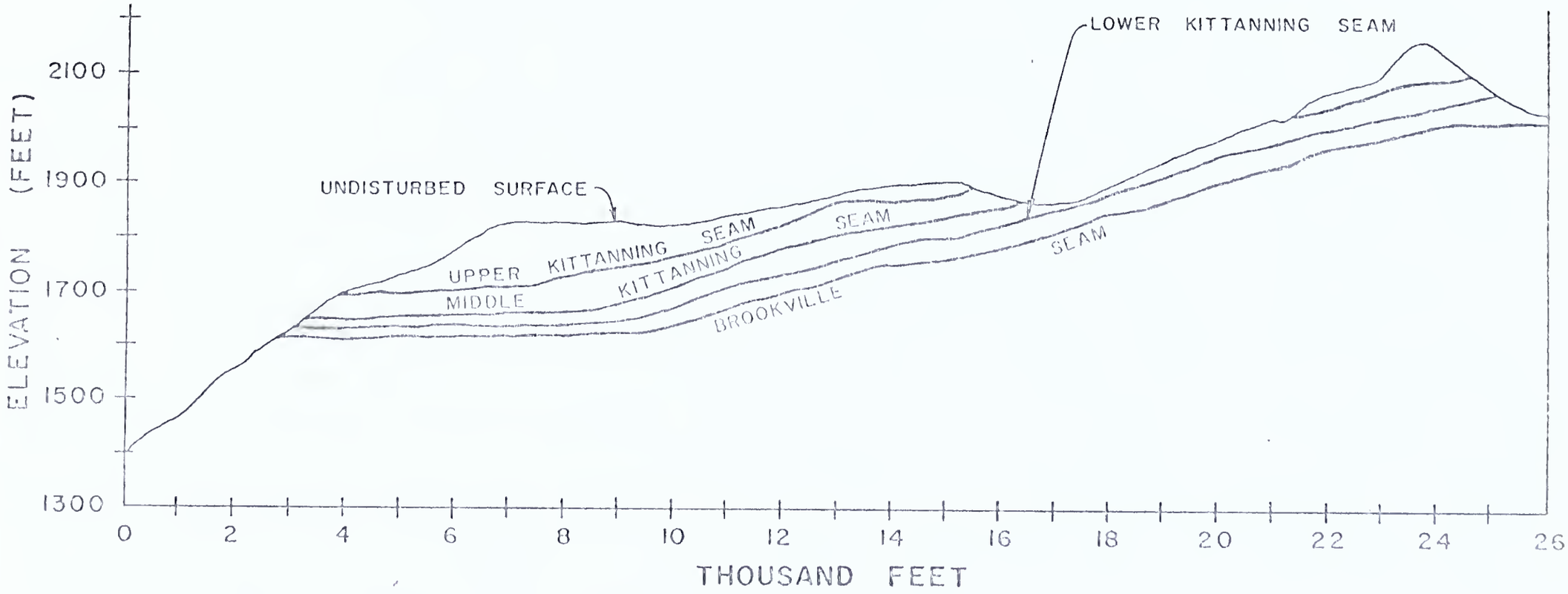

Figure 2 -- Section along synclinal axis showing configuration of coal seams in Tioga Coal Basin

conducted to allow for gravity discharge of mine drainage from these drifts. Therefore, surface and ground waters finding their way into deep mine workings may flow for considerable distances over acid producing materials before eventually being discharged to surface streams as acid mine drainage.

All coal seams in the Morris Run area are in close proximity to the ground surface. The lowest seam subjected to extensive underground mining, namely the Lower Kittanning, is only 250 feet below ground surface at its maximum depth. The underground voids created by mining have caused extensive fissuring of the overburden throughout a significant part of the area. In some sections, the overburden has subsided into these underground voids. This fissuring and subsidence significantly reduces surface runoff and increases ground and surface water entry into inactive deep mine workings thereby increasing the severity of the acid mine drainage problem.

2. Major Surface Conditions Causing Acid Mine Drainage

As a result of past inadequate restoration, strip mines in the area serve as catch basins which collect, to varying degrees, direct precipitation, surface runoff, and ground water. Most of the waters so collected appear to find their way into deep mine workings through

fissures in the bottom of the strip mines or through connections created where a strip mine cuts directly into deep mine workings. Waters collected in strip mines have contact with acid producing materials located therein or connecting deep mines and are eventually discharged as acid mine drainage at one of the hereinbefore noted drifts or other discharge points. In cases where no direct connections exist between strip mine and inactive deep mine workings, water flows from the strip mine directly to surface streams creating another mine drainage point.

Refuse material from deep and strip mining on the surface of the Morris Run area is another source of acid water. All of the refuse, in varying degrees, is acid producing and forms a source of acid discharges during periods of wet weather.

3. Mine Drainage Impact

The quality of the Tioga River above its confluence with Morris Run is not significantly affected by mine drainage. Below this point, however, and for a distance of more than 30 miles, the stream is rendered acid by mine drainage from the watersheds of Morris Run, Coal Creek, Johnson Creek, and Bear Creek. Tributaries neutralize the acid load downstream from the

Cowanesque River. Biological studies indicate mine drainage inhibits aquatic life downstream to its confluence with the Canisteo River, an additional nine miles.

Johnson Creek - Although Johnson Creek contributes a weakly alkaline loading to the Tioga River, it receives mine drainage from abandoned surface and subsurface mines near the Village of Arnot, about four miles from its mouth. Mine drainage in the Arnot area overcomes the stream's alkalinity for a short distance. Concentrations of mine drainage indicators are low, however. Two discharges with a total acid loading of 300 lb./day are the major mine drainage sources.

A limited program of treatment and surface reclamation would probably improve water quality substantially. Costs and benefits associated with abatement are insignificant when compared with those for abatement in other sources in the Tioga River Basin.

Morris Run, Coal Creek, and Bear Creek - Although these three streams constitute individual sources of mine drainage to the Tioga River, underground and surface mining diverts surface and ground water from one watershed to another; for this reason, they are discussed together.

The total acidity from the three streams neutralizes the Tioga River's weakly alkaline reserve and produces an acid residual of 15,500 lb./day downstream from Bear Creek. The mean net acidity concentration downstream from Bear Creek is 180 mg/l; mean iron and manganese concentrations are 16 and 4.9 mg/l, respectively. Other mine drainage indicators are proportionately high.

The quality of each stream is essentially uniform from source to mouth. All have acidity concentrations of 500 to 1,000 mg/l, iron concentrations of 20 to 100 mg/l, and manganese concentrations of 20 to 50 mg/l. Morris Run receives mine drainage from two major as well as approximately 20 minor sources. Most of the drainage originates in abandoned, deep mines; however, their flow is influenced by drainage from strip mines.

The coal measures are isolated from the main bituminous field and cover an area of only about ten square miles. Abatement here could be done without involving a large geographical area. The extensive degradation of the Tioga River and the effect on uses of water to be impounded by the Tioga River Dam give the area a high priority for future abatement.

Abatement work will require an extensive program of surface reclamation and treatment. The estimated initial

cost is 6.8 million dollars, and the annual cost will be about 700,000 dollars.

II

DISCUSSION OF STUDY RECOMMENDATION

The study report clearly establishes that a need exists to abate acid mine drainage in the Tioga River Basin. The primary objective of the abatement program is to provide an alkaline water inflow to the Tioga Lake. A secondary and long-range objective of the program is the eventual elimination of acid loads to the Tioga River.

The abatement measures identified by the study may be classified as preventative or treatment. Preventative measures are those actions planned to prevent acid formation during and after mining. Treatment involves the removal of acid from a source point or an affected stream.

Five alternative plans of abatement were identified by the study. The first two alternatives include fairly extensive preventative measures combined with treatment of acid water only during periods of low stream flow.

Alternatives III and IV call for the use of treatment measures on a continuous basis and require a collection system to direct polluted (acid) water to the treatment facilities.

Alternative V would require all of the preventative measures

included in Alternatives I and II, a treatment facility and a collection system. Treatment would be continuous. This plan would completely eliminate the acid load to the Tioga River while the others would simply meet the objective of providing an alkaline flow into the Tioga Lake. This plan, Alternative V, does not have a favorable benefit/cost ratio.

The report notes that the first four alternatives are all acceptable; however, it suggests that I and II are most acceptable as they combine water quality improvement and land reclamation which provides permanent benefits. Of these two alternatives, number I is recommended for more detailed consideration.

III

AREAS OF CONCERN

The recommended plan of abatement, Alternative I, appears most acceptable of the four cost effective measures presented in the study. The inclusion in this plan of extensive preventative work and minimum reliance on treatment is commendable. The implementation of this alternative combined with careful management and regulation of on-going and future mining could well result in the eventual elimination of detrimental levels of acid discharges throughout the Tioga River Basin.

We do have some concern regarding the location of the treatment and collection facilities due to the possibility of interior collapse and blockage of mine tunnels and established seepage chan-

nels. In such event overflow and seepage could occur through other or new outlets by-passing the treatment and collection facilities. Such an occurence is not uncommon in abandoned mines, particularly in extensive deep mined coal seams with drift entries, as found in the Tioga Basin.

Also Alternative I, as presented, would collect acid water directly from three point sources, but would not have non-point source collection potential. The study does not identify the amount of acid contribution from non-point sources; however, combined with other recognized sources the acid load becomes significant and might be considered in more detailed studies.

Another area of concern is the structuring of mine drainage abatement programs. The study does not identify responsibility for implementation of the abatement plans. Traditionally, abatement programs have been the responsibility of State and local governments. Historically, coal has been mined to produce energy for the entire Nation. With the beginning of the industrial revolution through World War II, coal was primary source of energy used for production of goods and for power to distribute the products across the Nation. Seventy-five percent of the mines in the Susquehanna River Basin that once produced great quantities of coal are now abandoned and many remain the source of acid drainage which seriously degrades the waters of the Susquehanna River. This condition will remain relatively stable unless specific remedial action is taken. With the current

energy shortfall, coal, our currently most abundant energy resource, will be mined in increasing volumes. Some of this increased mining will help solve the abandoned mine drainage problem because miners will be reaffecting old mines and thereby become responsible for their reclamation. However, the vast majority of the acid mine drainage will have to be abated by a serious, concerted all-out government effort using all the resources at our command.

Considerable progress has been made in controlling and/or eliminating pollution from municipal and industrial wastes, and from active and future mines in the Susquehanna River Basin. The full potential of this progress cannot be realized unless water quality degradation by acid discharges from abandoned mines is eliminated. Acid mine drainage is the only significant National water pollution problem that is not the focus of a major Federal action program. Present Federal policy on drainage from abandoned coal mines is limited to research and demonstration activities because remedial programs are complex and costly. However, sufficient technology now exists to eliminate much of this pollution and the responsibility for abatement of mine drainage must be shared by the National government.

IV

SUMMARY AND RECOMMENDATIONS

The Tioga River is degraded by acid mine drainage for a

distance downstream of 25 miles to the New York State border. Three tributaries, Morris Run, Coal and Bear Creeks, that drain a small coal basin in the headwaters of the Tioga River Basin are extremely degraded by acid mine drainage from abandoned mines. This is a major local as well as regional problem in the Susquehanna River Basin. An effective acid mine drainage abatement program is needed to improve the water quality in the basin.

High priority is given to abatement of acid mine drainage in the Tioga River Basin because of benefits to the future Federal impoundments on Tioga River and Crooked Creek. These multi-purpose dams are presently under construction by the Corps of Engineers.

In recognition of the acid mine drainage problem in the Tioga River Basin, the Corps of Engineers conducted a study to identify acid mine drainage abatement alternatives that would accomplish significant increases in stream usefulness and benefit Tioga Lake. Results of the study appear in the Susquehanna Mine Drainage Study - Interim Report, Tioga River Basin.

Review of the above draft report revealed two major areas of concern:

(1) The most acceptable choice presented, alternative one could be affected by a breakout of mine drainage, which could by-pass the treatment facilities or collection system rendering them ineffective.

(2) The assignment of responsibility for implementation of measures to abate mine acid drainage to the Tioga River was not clearly identified.

In response to these concerns, the staff submits for Commission consideration the following recommendations:

(1) Preventative measures identified in Alternative I should be implemented as the initial step of a plan to meet long-term abatement objectives. Implementation of the treatment measures should be delayed until an evaluation of the effectiveness of the preventative measures is made. During engineering-design stages of the treatment plants, necessary modifications should be made to (a) compliment the effectiveness of the preventative measures and (b) locate the facilities at the lowest part of the coal basin outside the Tioga River 100-year flood plain.

(2) The primary responsibility for abatement of mine acid discharges in the Tioga River Basin should be accepted by the Federal government to assure that all objectives of the Tioga-Hammond Lakes Project be met.

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